

SURVEILLANCE PLAN FOR PESTICIDE-RELATED ILLNESS IN RESPONSE TO  
AERIAL PESTICIDE APPLICATION TO REDUCE HUMAN HEALTH RISKS  
ASSOCIATED WITH WEST NILE VIRUS/EASTERN EQUINE ENCEPHALITIS

Prepared By

The Massachusetts Department of Public Health

Center for Environmental Health

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## Background:

Public health impacts associated with both West Nile (WNV) and Eastern Equine Encephalitis (EEE) viruses appear to follow approximate 3 year cycles when the threat of human disease may be higher. During the late summer of 2005 a significant number of mosquito pools tested positive for WNV/EEE. However, due to factors associated with the lateness in the season (e.g. colder temperatures, mosquitos flying closer to the ground) and the time needed to prepare for aerial spraying (i.e. identification of funds/purchase of pesticide, coordination/scheduling of planes and adequate public outreach/notification) the risk/benefit decision was not to apply aerial applications anywhere in Massachusetts. The last time aerial application of adulticides for EEE occurred in Massachusetts was in 1990.

Given that the risk of EEE in particular remains high for the summer 2006 season, it is important that a protocol for reporting any pesticide related illness (PRI) be established apriori. This protocol was developed by staff in the Center for Environmental Health (CEH). The CEH is responsible for helping to select the adulticide of choice and for conducting pesticide related illness surveillance if a decision is made to conduct aerial application. The PRI surveillance protocol is part of the department's comprehensive plan to address disease concerns associated with EEE and WNV. The comprehensive plan was developed by the Massachusetts Department of Public Health in collaboration with environmental regulatory agencies and mosquito control experts. Activities include the trapping and testing of mosquitos across the state, conducting surveillance for human disease, and others. The plan involves the collaboration and cooperation of a number of individuals and organizations beyond the Department of Public Health, including representatives from the Department of Agricultural Resources, the mosquito control board, the Department of Environmental Protection and an external advisory committee to the MDPH/MDAR.

## Introduction:

Several counties in the highest risk areas contain large areas of fresh water red maple and white cedar swamps, wetlands, marshes, bogs and woodlands. This habitat supports many mosquito species including Culiseta melanura, the enzootic vector of the EEE virus.

Eastern Encephalitis (EE), a relatively rare but serious disease in equines and humans, is caused by a virus which is carried by certain species of wild birds living in freshwater swamps. The virus typically circulates between the Culiseta melanura, a non-human biting mosquito, and wild birds. Occasionally, due to factors not yet fully understood, a spillover into mammalian (i.e. horse and human) biting mosquito species occurs establishing the basis for transmission to humans.

According to data from the communicable disease surveillance program, most EE cases have occurred in children under the age of 12. Although EE epidemics are small in size, they often result in severe outcomes. In general, approximately 50 percent of the known cases in Massachusetts have been fatal. The most recent data (2004 & 2005) demonstrated four cases each with two deaths in each of those years. As mentioned previously, the risk of EE in humans remains high for the 2006 season. Several observations support this increased risk: (1) detection of EEE in mosquitos late in the 2005 season (2) above average precipitation in the Fall/Winter of 2005 and the Spring of 2006, and (3) above average groundwater levels in the Spring of 2006.

Surveillance of mosquitos across the state began in May of this year. If mosquito pools test positive for EEE during the month of June, all of the criteria that led to aerial application in 1990 will have been met. The remainder of this protocol includes a discussion of the adulticide of choice as well as methods to respond to public inquiries associated with pesticide exposure concerns and surveillance for any unanticipated events of pesticide exposure and human health impacts via hospital emergency departments in the state.

### Mosquito Adulticide Selection

Four pesticides were evaluated for use in the aerial spray program. All four pesticide products considered by the inter-agency work group meet both the federal and state regulatory standards for registration and when used in accordance with warnings, cautions, and directions for the uses for which they are registered, will not generally cause unreasonable adverse effects on the environment or human health. These included Scourge (active ingredient resmethrin), Anvil 10+10 (active ingredient sumithrin), Kontrol 30+30 (active ingredient permethrin), and Fyfanon (active ingredient malathion). These pesticides were subsequently evaluated using several parameters, including:

- Formulation
- Label “Signal” Word
- Use classification
- Chemical components
- Percentage of active ingredient
- Application rate
- Half-life
- Aquatic toxicity

The chemical properties of sumithrin with consideration of its toxicity and environmental fate profile; overall, indicate that sumithrin provides the widest margins of safety for human health and the environment when used properly by professionals trained to conduct mosquito control. It should be further noted that studies show sumithrin to be short-lived in the environment, to break down rapidly in sunlight, and to be less toxic to aquatic species than the alternatives considered.

## Toxicology

### Anvil 10+10 (Sumithrin)

Anvil 10+10 is the trademark name of a product containing the active ingredient sumithrin. Sumithrin is a synthetic pyrethroid insecticide whose active ingredient is similar to pyrethrins, which are derived from chrysanthemum plants. Sumithrin has been registered with EPA since 1975 and with the Massachusetts Department of Agriculture Resources Pesticide Bureau since 1980. It is used commercially (e.g., in food handling establishments), as well as by homeowners to control insects in homes and gardens and on pets. It is classified as a “general use” product, meaning that its use is not limited to professionals alone, but may be purchased and used by the general public. Of the three pyrethroid products (i.e., permethrin, resmethrin, and sumithrin) evaluated by the Department of Environmental Protection, Office of Research and Standards, for aquatic toxicity, sumithrin was also the least toxic to fish. Its half-life (1-3 days) was more than resmethrin (half-life of hours), but less than permethrin (half-life of 3-5 days).

When used in mosquito control, sumithrin is mixed with a synergist (i.e., PBO) that increases its potency and duration of effectiveness and a solvent/diluent (i.e., mineral oil). The clinical manifestations of inhalation exposure to pyrethrins can be local or systemic. Localized reactions confined to the upper respiratory tract may include rhinitis, sneezing, scratchy throat, oral mucosal edema, and even laryngeal mucosal edema. Localized reaction of the lower respiratory tract may include cough, shortness of breath, wheezing, and chest pain. An asthma-like reaction occurs with acute exposures in sensitized patients. Symptoms that may also be reported if there have been overexposures include dizziness, headache, nausea, twitching, reduced energy, and changes in awareness. The systemic effects resulting from exposures to pyrethroids are related to their action on the nervous system. Pyrethroids exert their profound

effect by prolonging the open phase of the sodium channel gates when a nerve cell is excited. In rodents, effects such as tremors are induced if the open state is prolonged for brief periods; effects such as sinuous writhing (choreoathetosis) and salivation occur if the open state is prolonged for longer periods. Neurologic signs typically result from acute toxicity. Low-level chronic exposures to pyrethroids usually do not cause neurologic signs in mammals, largely because of rapid metabolism and elimination. Data from animal studies do not indicate that pyrethroids significantly affect end points other than the nervous system. A few recent animal studies indicate the potential for adverse neurodevelopmental, reproductive, and immunologic effects at exposure levels below those expected to result in overt signs of neurotoxicity. There is evidence from animal studies that pyrethrins, pyrethroids, and synergists (i.e., PBO) that are included in the commercial product might be capable of causing cancer in people. However, this is unlikely with regard to aerial spraying due to the limited exposure amounts and duration.

#### Methods:

##### Surveillance

Two major components are involved in the surveillance of PRI related to aerial application of adulticides to reduce the risk of human EE/WNV. They include working with emergency department personnel in the areas of the state designated as highest risk for disease (Plymouth, Norfolk, Middlesex, Suffolk, and Bristol counties), as well as the Poison Control Centers, in the unlikely event of exposure related illness and working with residents and local health officials to respond to questions and concerns related to the adulticide of choice. Figures 1-5 show the hospitals with emergency departments in each county and their respective physician contacts. In addition, contact will be made with the Massachusetts Poison Control Center to request reports they may receive via their hotline regarding possible pesticide related

illness. As discussed, this protocol will be distributed via mail by early August in order to familiarize hospital and poison control personnel with the plan itself as well as the abstraction form to be used for surveillance. A copy of the abstraction is included as Appendix A.

Completed abstract forms should be sent by fax to 617-624-5777.

In addition to pre-distribution of the form, hospital and poison control contacts have also been provided with the Department's toll free number (1-866-627-7968) established by the arbovirus program. This line has a direct linkage with the Center for Environmental Health for PRI and related questions.

The hotline will be staffed by the CEH's environmental health surveillance unit (EHSU). EHSU staff will carry out the surveillance of PRI for CEH and will triage public and local health inquiries associated with pesticides with the CEH's Environmental Toxicology Program (ETP).

#### Notification/Communication

The MDPH established the Health and Homeland Alert Network (HHAN) to communicate with a variety of partners as part of its emergency preparedness planning. In brief, the HHAN is a secure and robust electronic communication system with the capacity to notify or "alert" a large number of individuals simultaneously in the event of a public health emergency or other important public health event. All Massachusetts hospitals and most local health officials are connected to the HHAN.

Once the decision is made to conduct aerial application of adulticide in geographic areas across the state, a HHAN alert will be sent out in coordination with the Department's Center for Emergency Preparedness (CEP). The CEP serves as the point of contact for public health emergencies and coordinates response activities that involve multiple program areas within the MDPH. Following that, staffing of the hotline will be activated.

Appendix A  
Pesticide Related Illness  
Surveillance Abstraction Form  
Emergency Department or Poison Control Center

Patient/Caller Name: \_\_\_\_\_ Date: \_\_\_\_\_

Time: \_\_\_\_\_

Patient/Caller Address: \_\_\_\_\_

Approximate Location/Address where patient/caller was stricken: \_\_\_\_\_

Sex:    Male                      Female                      Age: \_\_\_\_\_

**SYMPTOMS:**

(Check all that apply)

nausea	wheezing	respiratory irritation
cough	shortness of breath	sneezing
chest tightness/pain	eye irritation	asthma attack
other		

Please Explain: \_\_\_\_\_

**NATURE OF EXPOSURE:**

Outdoors in area of aerial spraying

Indoors in area of aerial spraying

Contact with possible pesticide residue (e.g. yard furniture)

Other (please explain) \_\_\_\_\_

Pre-existing illness or conditions possibly related:

\_\_\_\_\_  
\_\_\_\_\_

Name of ED/Poison Control staff completing the form: \_\_\_\_\_

Telephone Number: \_\_\_\_\_

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